HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA

THE QUEENSTON-CHIPPAWA POWER DEVELOPMENT

CHAPTER "L"—EVOLUTION OF THE DEVELOPMENT

WALTER J. FRANCIS & COMPANY

CONSULTING ENGINEERS

Chapter L.

EVOLUTION OF THE DEVELOPMENT

Walter J. Francis.

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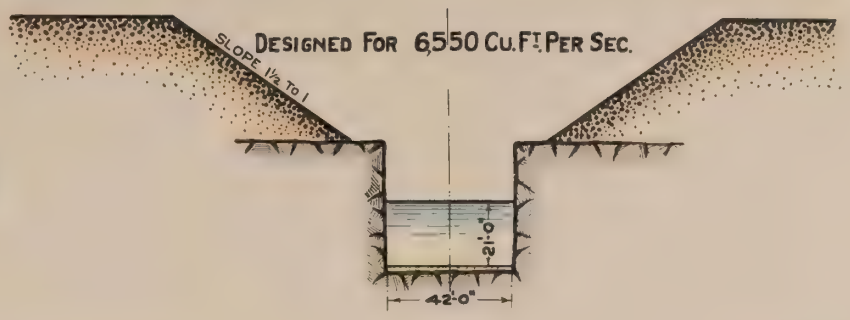
Chapter L.

EVOLUTION OF THE DEVELOPMENT.

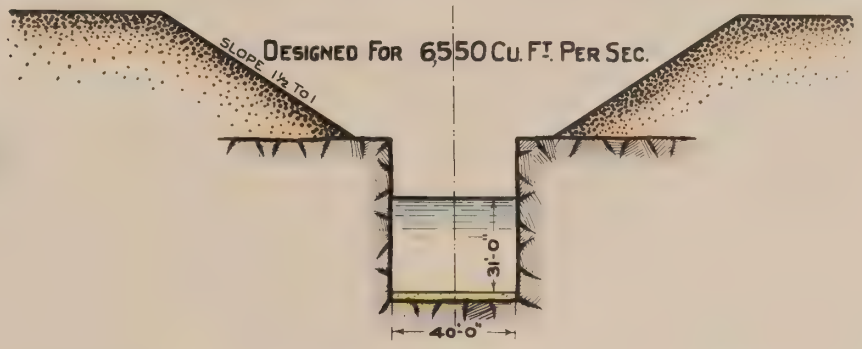
Walter J. Francis

When the first studies were made of the Queenston-Chippawa Power Development with the intention of utilizing the maximum available head between Lake Erie and Lake Ontario, the estimated surplus of water under the terms of the International Treaty was considered by the engineers of the Hydro-Electric Power Commission to be 4,500 cubic feet per second. To this figure they added an amount to allow for the possible flow from the Welland River, and the preliminary designs were therefore based on a flow of 6,550 cubic feet per second. With this quantity in mind, the engineers of the Hydro-Electric Power Commission developed a canal design with a width of 42 feet and a depth of water of 21 feet. The sides of this proposed canal were to be channelled, and the floor was to be paved with concrete. A typical cross-section of this design such as would apply to the greater part of the southerly rock section of the canal, is shown in diagram "A" on the drawing included herewith as page L-2. This design was adhered to during all the preliminary studies, and estimates made in 1915 and 1916. At the time these preliminary designs for the canal were being prepared a study was also made for the proposed power house. The drawing included herewith as page L-3 shows a cross-section of the Screen House, Trans-

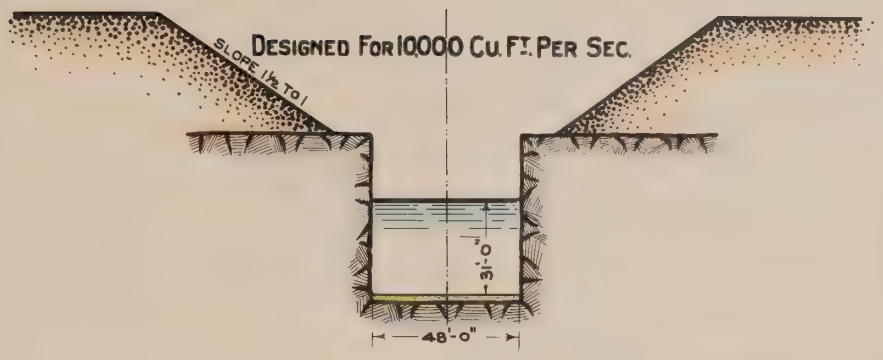
A



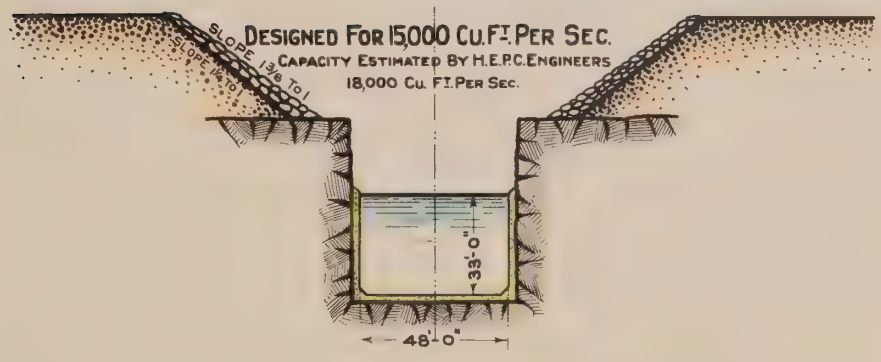
B



C



D



NOTE:—

THE ABOVE CROSS SECTIONS APPLY AT A STATION IN THE CENTER OF THE SOUTHERLY ROCK SECTION. AND ARE TYPICAL FOR THE CANAL EXCAVATED IN ROCK

Scale of Feet

HYDRO-ELECTRIC INQUIRY COMMISSION

W. D. GREGORY—CHAIRMAN

QUEENSTON-CHIPPAWA POWER DEVELOPMENT

EVOLUTION OF THE CANAL SECTION

Scale as Indicated

Toronto, July 6th 1922 Made by [illegible] Checked by [illegible]

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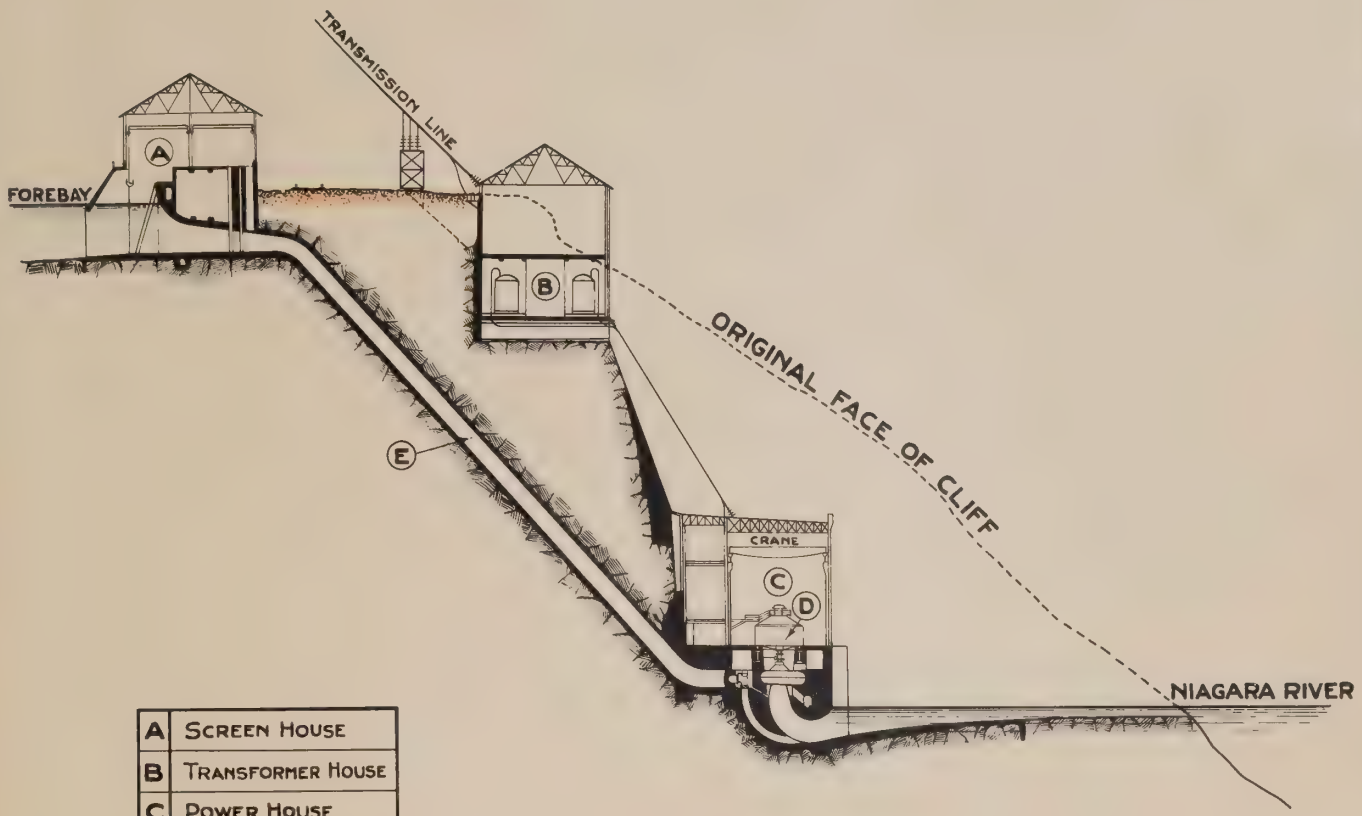

A	Screen House
B	Transformer House
C	Power House
D	Generator
E	Penstock

As Proposed June 1915

0 10 20 30 40 50 60 70 80 90 100 150 200

Scale of Feet

Hydro-Electric Inquiry Commission

W. D. Gregory-Chairman

Queenston-Chippawa Power Development

Study of Projected Power House

June 1915

Scale as Indicated

Toronto, June 9th 1922 Made by CMD Checked by [illegible]

Walter J. Francis, C.E.,

Consulting Engineer

former House and Power House, together with the type of Penstock, as then contemplated.

In February, 1917, Mr. L. D. Johnson made his first report outlining the studies he had made in connection with the capacity of the canal as designed by the engineers of the Hydro-Electric Power Commission. Mr. Johnson recommended changing the shape of the cross-section of the canal, and as a result the width was changed from 42 feet to 40 feet, and the depth of water was increased from 21 feet to 31 feet. His reasons for making this recommendation were first, that the hydraulic losses in such a canal would be somewhat less than in the design submitted to him for consideration; and second, that the excavating machinery could be more efficiently used in his proposed cross-section. A typical cross-section, as adopted following the recommendations of Mr. Johnson, is shown in diagram "B" on the drawing included herewith as page L-2.

Early in 1917 the possibility of obtaining control of the Ontario Power Company's plant is stated to have led to the decision to increase the canal capacity. A flow of 10,000 cubic feet per second corresponding to an output at the power house of 300,000 horse power, was then adopted. It was considered by the engineers of the Hydro-Electric Power Commission that with the Ontario Power Company's plant under their control, it would be desirable to withdraw some of the water used at that plant and utilize it under greater efficiency in the Queenston-Chippawa plant. For the capacity of 10,000 cubic feet per second, a canal was designed with a width of 48 feet and a depth of

water of 31 feet. The sides were to be channelled and the bottom was to be paved with concrete. A typical cross-section of this design of the canal is shown in diagram "C" on the drawing included herewith as page L-2.

Following further studies of the hydraulic characteristics of the canal with particular reference to its capacity, it was decided late in the year 1917 to increase the depth of the rock-cut so as to provide 33 feet of water instead of 31 feet as heretofore contemplated, still retaining the flow at 10,000 cubic feet per second.

Early in the year 1918 it is stated that the increase in demand for power led the engineers of the Hydro-Electric Power Commission to carry out further studies with the object of providing a canal with a larger capacity than that of any of the previous designs. After consultation with Mr. Johnson, they concluded that it would be possible to provide for a flow of 15,000 cubic feet per second, the equivalent of an output of 450,000 horse power, with comparatively little increase in the cost of the canal. The additional flow was to be obtained by improving the hydraulic characteristics of the canal rather than by increasing its cross-sectional area. To this end a concrete lining was substituted for the channelled rock sides, leaving the neat dimension of the canal at 48 feet wide and with 33 feet of water. Diagram "D" on the drawing included herewith as page L-2 shows the type of section ultimately adopted and constructed.

Upon the canal being put into operation, the engineers of the Hydro-Electric Power Commission were enabled to make further detailed studies of the behaviour of the water with particular reference to such elements of

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their calculation as heretofore could only be determined on a theoretical basis, and they have now calculated that the finished canal will in all probability pass 18,000 cubic feet per second, giving an output of about 540,000 horse power.

Walter J. Francis

Consulting Engineer.

Toronto, July 20th, 1922.

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